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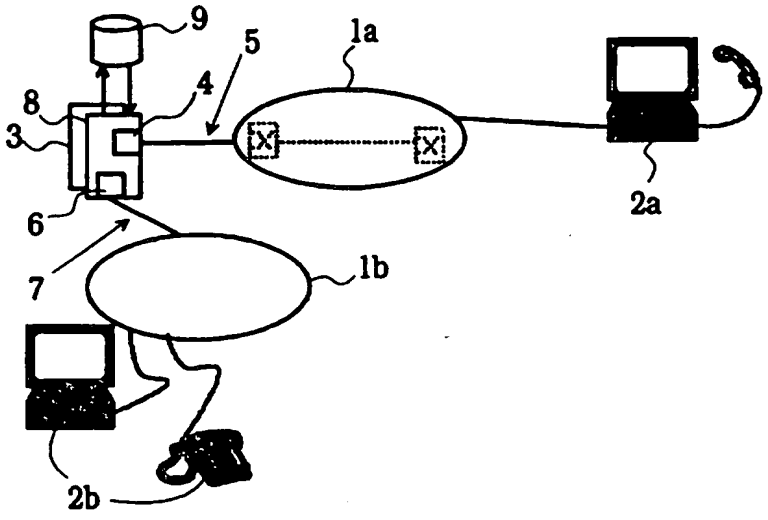

(57) Abstract

The present invention relates to a telecommunication system. In particular, the present invention relates to a telephone system operated via a computer network and to a procedure for its control. The invention makes it possible to achieve a telecommunication system in which calls are transmitted in a packet switching computer network from one computer to another, from a computer network to a public telephone network and vice versa. Furthermore, the invention makes it possible to add services based on an intelligent network to calls made over a computer network.

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Gateway between Networks using Different Protocols

The present invention relates to a telecommunication system. In particular, the present invention relates to a telephone system operated via a computer network and to a procedure for its control. The present invention concerns a telecommunication system as defined in the preamble of claim 1 for the transmission of telecommunication signals carrying information. In addition, the present invention concerns a procedure as defined in the preamble of claim 9 for the control of a telecommunication system.

Previously known is a telecommunication system comprising a telephone network over which telecommunication signals are transmitted between two terminal devices. A typical example of the use of a telephone network is the setup of a normal call between two telephones connected to the telephone network. Systems are also known in which solutions based on an intelligent network are used in conjunction with a telephone network. A description of such solutions is to be found e.g. in the article "Intelligent Networks: Dedicated to Services, Alcatel Electrical Communication, Vol 65 No 1". An intelligent network makes it possible e.g. to charge a given credit card number for a call or to redirect a customer call to a free telephone service at the end of a logical chain. Via an intelligent network, other services of a corresponding nature can be made available to the customers. On the other hand, services corresponding to those of an intelligent network, and in some cases even more comprehensive services, can be implemented by using a so-called virtual exchange. A more detailed description of a virtual exchange is to be found in Finnish patent application FI-954619, filed by the present applicant. The telecommunication system described above makes it possible to implement very intelligent and customer-friendly telephone network services.

Previously known is also a telephone system operated in a computer network which differs from the conventional telephone system in that calls between any two users are realized by means of a computer or equivalent. Moreover, the number identifying the terminal device is the computer's IP address *(IP, Internet Protocol)* or NSAP address *(NSAP, Network Service Access Point)*, which is also used for other connections set up via computer. Such a telephone system is particularly effective when e.g. a packet switching network is used. Via the connections in such a network it is possible to transmit large amounts of data, allowing moving images and sound to be transmitted over the same connection. However, in a computer network it is not possible to make use of services like those provided by an intelligent network or a virtual exchange, such as enquiry calls, call transfer, etc.

Further, patent specification EP 0666670 presents a protocol adapter, a so-called gateway, which is a device for adapting the data link layers of two different protocols to each other. According to the specification, the adaptation is performed between packet switching protocols so that the gateway adapts the header data of a packet consistent with a first protocol into a specified general format, through which the data are transferred into a format acceptable for a second protocol by changing the header data according to the second protocol.

As the number of computers is increasing, there is an increasing demand for systems that allow the computer to be used for all possible tasks, including calls, in addition to word processing, simulation and other types of work performed by means of computers. However, the problem is that not all computers are connected to a common data network, such as the Internet, so as to allow calls between computers to be set up as desired. Moreover, as stated above, intelli-

gent network services cannot be implemented using a telephone system in a computer network. For this to be possible, there must be a way to establish a connection from the computer network to a public telephone network and vice versa. The problem is that different networks use completely different communication protocols, call setup procedures, transmission speeds, etc., in other words, the networks are completely different. Especially computer networks and telephone networks differ from each other, so when a telecommunication connection is to be set up between a telephone network and a data network, terminal devices compatible with each other must be used. For example, when two computers are to be linked via a data network and a telephone network, it is necessary to connect a modem between the telephone network and the computer to handle the communication over the telephone network, but the connection is set up using only a packet switching protocol, such as the TCP/IP, acceptable to the computer.

The object of the present invention is to eliminate the problems described above. A specific object of the present invention is to produce new and effective telecommunication system that allows communication between a packet switching computer network (e.g. *ATM, Asynchronous Transfer Mode*) and a digital circuit switching telephone network (e.g. *ISDN, Integrated Service Digital Network*) to be implemented by adapting the packet switching protocol of the computer network and the circuit switching protocol associated with the telephone network to each other.

Another object of the present invention is to produce a procedure for controlling a telecommunication system so that connections between a telephone connected to a telephone network and a computer connected to a computer network can be set up in the telecommunication system.

A further object of the present invention is to produce a telecommunication system that allows intelligent network services available in a telephone network to be used in communication connections set up in a packet switching data network.

As for the features characteristic of the present invention, reference is made to the claims.

The telecommunication system of the present invention comprises two telecommunications networks, such as packet switching computer networks, ATM networks, intelligent networks, ISDN networks or the like, two terminal devices, such as telecommunication terminals, telephones, mobile stations, computers or the like, which are connected to a telecommunications network for the transmission of telecommunication signals carrying information. According to the invention, the telecommunication system comprises a gateway connected to a telecommunications network to transmit telecommunication signals between two telecommunications networks, each of which uses a different telecommunication protocol. Preferably one of the telecommunications networks is a packet switching computer network and the other a telephone network.

As compared with prior-art technology, the invention provides the advantage that the telecommunication system of the invention allows a telephone application used in a packet switching telecommunications network and a telephone application used in a normal telephone network to be so interconnected that calls can be connected from the computer network to the telephone network and vice versa. A further advantage of the present invention as compared with prior-art technology is that the telecommunication system of the invention allows intelligent network services to be implemented even in telephone applications used in computer networks.

A further advantage of the present invention

is that it allows telephone communication via an effective packet switching computer network, such as an ATM network.

In a preferred embodiment of the present invention, the gateway comprises a first buffer element designed to adapt a first signalling interface between a telecommunications network and the gateway, a second buffer element designed to adapt a second signalling interface between a telecommunications network and the gateway, and an adapter which is electrically connected to the first and second buffer elements to interconnect the first and second signalling interfaces. The buffer elements used are preferably circuit boards known in themselves, connected to a computer, workstation or equivalent. The adapter used is preferably a workstation, a personal computer or equivalent. Furthermore, it is to be noted that the buffer elements and the adapter can also be implemented as one and the same workstation, circuit board, ASIC circuit (*ASIC, Application Specific Integrated Circuit*) or equivalent.

The essential functions of the gateway are its capability of transmitting voice and data calls both between a public telephone network and a packet switching computer network and within a packet switching computer network. The ability to transmit voice and data calls between a public telephone network and a packet switching computer network makes it possible to use the properties and services of a public telephone network by means of terminals, such as workstations, connected to a packet switching computer network. The ability to transmit calls within a packet switching computer network allows the properties of existing telephone, mobile telephone and intelligent network services to be used in a packet switching network as well. In practice, this is implemented so that the gateway connects the call via an intelligent net-

work and the intelligent network is used to add services to the call connected. In other words, the gateway enables the existing services to be realized in a new network architecture while at the same time acting as a gateway to the existing architecture and services. As for the transmission of data and voice, the operation of the gateway is transparent, and it is also able to connect calls on the basis of intelligent network control and computer searches.

Moreover, the essential function of the gateway is associated with the terminal identification data, i.e. with the network addresses of computers, such as converting IP addresses into a format intelligible to a telephone network, and converting telephone numbers into a format intelligible to a computer.

The signalling interfaces between a terminal connected to a computer network and the gateway can preferably be implemented in at least two ways. In the first embodiment, the implementation is as follows: A permanent circuit (*PVC, Permanent Virtual Circuit*) is provided between an ATM terminal and the gateway. The signalling (call setup protocol) required between the terminal and the gateway is transmitted using the TCP/IP protocol (*TCP/IP, Transmission Control Protocol, Internet Protocol*). Besides the TCP/IP protocol, no other standards or recommendations are associated with this implementation. In addition, it is possible to use a protocol implemented on top of the TCP/IP protocol, or some other protocol for a packet switching network.

In another embodiment, the implementation is as follows: A switched virtual circuit (*SVC, Switched Virtual Circuit*) is provided between an ATM terminal and the gateway. The connection at the interface is set up using DSS#2 (*DSS, Digital Signalling System No. 2*) signalling (ITU-T Q.2931 standard).

In a preferred embodiment, the second signal-

ling interface is a signalling interface between a telephone network, such as an ISDN network, intelligent network or the like, and the gateway. It should be noted that all the signalling interfaces mentioned here are intended to be taken as examples, while the basic idea of the invention can be implemented by using any signalling method or their combination within the framework permitted by the technology used in each case.

In a preferred embodiment of the system of the invention, the telecommunication system comprises a database in which it is possible to store the identification data, preferably a telephone number, of a terminal connected to a computer network, corresponding to a TCP/IP address. In practice, the database may be located in any part of the system. Preferably the database is disposed in conjunction with the gateway. In another preferred embodiment, the database is connected to an intelligent network or a virtual exchange.

The numbering used in a computer network and that used in a telephone network are adapted in the gateway as follows. A normal unambiguous telephone number is allocated to each terminal connected to the computer network. The data network address and the unambiguous normal telephone number of the terminal make up a number pair. This number pair is stored in the database, from where a number conversion from one number to another can be performed (symmetrically) upon inquiry. In this embodiment, the data network number may be either a TCP/IP address (32-bit unsigned integer) or an ATM NSAP address.

In the procedure of the invention for the control of a telecommunication system, which telecommunication system comprises two telecommunications networks, such as ATM networks, intelligent networks, ISDN networks or the like, two terminal devices, such as telecommunication terminals, telephones, mobile

stations, computers or the like, which are connected to a telecommunications network, for the transmission of telecommunication signals carrying information, according to the invention, a telecommunications network is provided with a gateway for the transmission of telecommunication signals between two telecommunications networks using different telecommunication protocols and a connection is set up between the two terminals via the gateway.

In a preferred embodiment of the present invention, a first connection is set up between a terminal and the gateway via a first buffer element, a second connection is set up between a terminal and the gateway via a second buffer element, and the first and second connections are interconnected via an adapter.

In another preferred embodiment, a first connection is set up in a permanent virtual circuit using the TCP/IP protocol. On the other hand, the first connection may be set up in a switched virtual circuit using DSS#2 signalling.

In a preferred embodiment of the procedure of the invention, a first terminal is connected to a telephone network and a second terminal is connected to a data network, and a connection from the first terminal to the second terminal is set up as follows:

data identifying the second terminal is added to a telecommunication signal via the first terminal;

the telecommunication signal is sent into the telephone network via the first terminal;

the data identifying the second terminal is compared in the telephone network to determine the data network address of the second terminal and the address of the gateway connected to the data network;

the identification data is converted into a data network and gateway address;

based on the identification data, the telecommunication signal is routed to the second terminal

connected via the gateway to the data network; and

a telecommunication connection between the first and second terminals is set up via the gateway.

In another embodiment of the procedure of the invention, a first terminal is connected to a data network and a second terminal is connected to a data network or a telephone network, and a connection from the first terminal to the second terminal is set up as follows:

data identifying the second terminal is added to a telecommunication signal via the first terminal;

the telecommunication signal is sent to the gateway;

a connection is set up between the first terminal and the gateway;

a connection is set up between the gateway and a telephone network, which is preferably an intelligent network or equivalent;

the identification data for the second terminal is compared with a predetermined table to determine the address of the second terminal, whereupon

1) if the address of the second terminal refers to a telephone network, then a connection is set up between the first and second terminals;

2) if the address of the second terminal refers to a data network, then the identification data is converted into the address of the second terminal in the data network, the address of the second terminal is indicated to the first terminal and a connection is set up between the first and second terminals via the data network using a data network call setup protocol known in itself. In this way, the location of the receiving terminal is checked to save gateway resources, because when a call is to be set up between two terminals connected to a data network, it is preferable to use a direct data network connection between the terminals.

The terminal identification data corresponding to the data network address of a terminal connected to a data network is preferably stored in a database in the form of a number pair so that a given data network address can be symmetrically converted into a corresponding number and vice versa. This conversion is generally performed by using intelligent network services.

In the following, the invention is described by the aid of a few examples of its embodiments by referring to the attached drawing, in which

Fig. 1 presents a diagram representing a telecommunication system according to the present invention;

Fig. 2a - 2b present signalling interfaces used in the gateway;

Fig. 3a presents a diagram representing the architecture of a system according to the invention;

Fig. 3b presents a diagram representing the architecture of another system according to the invention;

Fig. 4a represents a signalling system used in the telecommunication system of the invention;

Fig. 4b represents a signalling system used in the telecommunication system of the invention;

Fig. 5 presents the user interface of a terminal belonging to the telecommunication system of the invention; and

Fig. 6 presents a diagram representing a gateway according to the invention.

The telecommunication system presented in Fig. 1 comprises two telecommunications networks, a data network 1a and a telephone network 1b, which may be an ISDN network, a PSTN network (*PSTN, Public Switched Telephone Network*) or a mobile communications network. The two networks are interconnected via a gateway 3. Moreover, the system comprises a terminal 2a

connected to the data network and a terminal 2b connected to the telephone network. Terminal 2a may be a UNIX based workstation, PC or the like. Terminal 2b may a telephone, mobile station, modem or the like. Furthermore, the system illustrated by Fig. 1 comprises a database 9 connected to the gateway 3.

The gateway 3 is provided with a gateway program to control the operation of the gateway. In this example, both the gateway 3 and terminal 2a are implemented as UNIX workstations. The gateway program takes care of the setup of connections both to the workstation in the ATM network 1a and to the telephone network 1b. The user of the terminal can make calls from the workstation connected to the packet switching network to the public telephone network and also receive calls from the public telephone network.

Referring now to Fig. 2a and 2b, the structure and operation of the gateway 3 will be described. In this example, the gateway program is installed in a Sun Sparcstation 20 workstation with the Solaris 2.4 operating system. Connected to the workstation are a first buffer element 4, which in this example is an ENI-155s ATM card by Efficient Networks Inc., and a second buffer element 6, which in this example is a BRI-ELC-S ISDN card by Bintec GmbH. It is to be noted that other cards can also be used. Terminal 2a is also a Sun Sparcstation 20 workstation provided with an ENI-155s by Efficient Networks Inc. In this example, a TCP/IP protocol between the gateway and the terminal is used on top of an AAL5 (AAL, *ATM Adaptation Layer*) adaptation layer, Fig. 2a. The connection between the gateway and the ISDN switching centre is implemented using an ISDN access line, Fig. 2b. The control of the connection between the ISDN switching centre and the gateway is implemented using DSS#1 (ETS 300 102) signalling. The gateway program uses a DLPI-compatible (*DLPI, Data Link Provider Interface, UNIX Internatio-*

nal OSI Work Group Rev. 2.0.0) signalling interface 7 supplied by Bintec, which implements DSS#1 (ETS 300 102) signalling.

Next, reference is made to Fig. 3a and 3b. In the gateway, the connection between a telephone network and a terminal connected to a data network can be advantageously implemented by applying an architecture as presented in Fig. 3a. The architecture represented by Fig. 3a consists of a component chain comprising a terminal 2b, a gateway 3, the ISDN switching centre 1d of a telephone network 1b and the intelligent network switching centre 1c of the telephone network. In this architectural example, the gateway 3 may be owned by an organization other than the operator of the telephone network. The connection between the gateway 3 and the ISDN switching centre 1d is implemented in this example by using a system access line (ITU-T Q.931, 30B+D) provided with DSS#1 signalling. Between the intelligent network switching centre 1c and the ISDN switching centre 1d, a protocol known in itself is used.

In another embodiment, Fig. 3b, the architecture consists of a component chain comprising a terminal 2b, a gateway 3 and the intelligent network switching centre of a telephone network. Between the gateway 3 and the intelligent network switching centre, the gateway uses a switching centre access line (ITU-T, Q.761 [*ISUP, Integrated Services User Part*], Q.721 [*TUP, Telephone User Part*]) provided with SS#7 ISUP or TUP signalling. In this architectural example, the gateway equipment can not be owned by an organization other than the operator of the telephone network.

In the architectures presented, the function of the intelligent network, the intelligent network switching centre and the SCP (*SCP, Service Control Point*) controlling it is to take care of the required call routing, charging, collection of statistical data

required for invoicing and the adaptation of the identification data or telephone number to the data network address.

There are three different preferred ways to set up a telecommunication connection in the telecommunication system of the invention; from a terminal connected to a data network to a terminal connected to a public telephone network or to a terminal connected to another data network, and from a terminal connected to a public telephone network to a terminal connected to a data network. In the following, these three types of call setup are described in stages by the aid of three examples of preferred embodiments. The examples implement the transfer of a call made in an ATM network, transmitting voice or data coded by the conventional PCM (*PCM, Pulse Code Modulation*) coding system at a transmission speed of 64 kbit/s, to a public network or vice versa or to another telephone in the ATM network.

The implementation described in each example determines the routing of the calls, the charging, statistics and address management relating to the calls.

The ATM telephone or the terminal connected to a data network is allocated an individual number from the normal range of telephone numbers. This can be done either by reserving for ATM telephones a definite free range of numbers 90 5555 XXXX, where XXXX is a number between 0000-9999. The individual number - in this example 90 5555 1111 - is used to identify the ATM telephone and to direct calls reserved for this number to the relevant ATM access line.

In addition, it is to be noted that the following examples only describe the procedure used to set up a call. However, this provides a clear illustration of the manner of application of the standards, and other events relating to the progress of the call

can be easily derived from said standards on the basis of these examples.

EXAMPLE 1

When a call is to be made from a public telephone network to an ATM telephone, the above-mentioned individual number is normally dialled by means of the telephone. The call is routed and set up as follows. The user of the public telephone network dials a telephone number which falls within the number range defined for the gateway. Using normal traffic dispatch techniques, the call is directed to an intelligent network. The intelligent network analyses the dialled number, recognizes the number as an ATM telephone number and finds in the database the data network address corresponding to that number as well as the address of the gateway 3 serving this particular ATM telephone 2b. In addition, the intelligent network replaces the original dialled number with the number and data network address of the gateway in a manner to be described later on. Based on this address, the gateway tries to establish a TCP/IP connection to the ATM telephone 2a. Via the TCP/IP connection thus set up, the gateway 3 transmits the calling subscriber's number to the telephone application 2a. If the address of the ATM telephone cannot be found in the database or if there is no response from the telephone, the gateway breaks the connection to the public telephone network as prescribed by the standard. If the ATM telephone does respond, a voice connection is ready for use and audio can be transmitted.

Fig. 4a gives a rough illustration of the signalling in the architecture of Fig. 3a. A more detailed description of the signalling is to be found in documents relating to the ITU-T standard.

A voice connection is set up after the gate-

way has transmitted a DSS#1 CONNECT message to the telephone network exchange. The exchange will not make a backward voice connection before the DSS#1 message has been transmitted, because the ringing tone for the call is generated by the exchange. Therefore, the gateway 3 need not make a voice connection between the exchange ant the ATM application before the ATM application has sent a DSS#1 CONNECT.

In the application illustrated by Fig. 3b, the signalling is done in a way corresponding to the above case except that the ISDN switching centre 1d after the intelligent network switching centre is omitted and the gateway talks directly to the intelligent network switching centre by using the TUP/ISUP protocol, which is acceptable to the intelligent network switching centre. In practice this means that only the software used in the gateway is different.

The invoicing is handled by the normal telephone network subscriber invoicing procedure.

EXAMPLE 2

When a call is to be made from an ATM telephone to a public telephone network, the normal telephone network number is dialled via the ATM telephone. The call is routed and set up as follows. The user of the application feeds the telephone number into the user interface. The terminal 2a, an ATM telephone, sets up a connection to the gateway 3 using a predefined gate number and a predefined gateway address. The gateway accepts the connection request. The telephone application sends the number of the receiving terminal 2b via the TCP/IP connection thus set up. The gateway 3 reads the number and uses it to form a call setup request consistent with DSS#1 (ETS 300 102) to the public telephone network and then proceeds to transmit the ringing tones received from the ISDN net-

work to the TCP/IP connection and to transmit the audio digitized by the ATM telephone from the audio card, sent via the TCP/IP connection, to the ISDN network. The intelligent network identifies the calling ATM telephone on the basis of the data network address, creates an invoicing record, which is terminated at the end of the call, and replaces the data network address of the call to be routed with the listed number obtained from the database. The terminal 2a reads the ringing tones from the TCP/IP connection and transmits them to the audio card. Thus, the user of the terminal 2a can hear the various stages of call setup in the same way as on a conventional telephone. If the call is successfully set up according to the call setup procedures defined by DSS#1 (ETS 300 102), then a voice connection has been established.

If the call fails to be set up, the gateway breaks the TCP/IP connection. The user of the ATM telephone may cancel the call via the user interface by pressing a button provided for this purpose, causing the terminal to break the TCP/IP connection. The gateway 3 detects this and breaks the connection to the public telephone network. Alternatively, the user of the terminal 2b cancels the call by hanging up. The gateway will close the TCP/IP connection upon receiving from the public telephone network a closing signal consistent with the standard, unless the user of the telephone application has already broken the connection on the basis of ringing tones related to call setdown that he/she has heard.

In this example, the signalling takes place roughly in the following manner, illustrated by Fig. 4b, in the architecture of Fig. 3a when DSS#2 signalling is used between the gateway 3 and terminal 2b. A more detailed description can be found in the ITU-T documents. When the response to the CONNECT signal is CONNECT ACK, the connection becomes active and a voice

connection is definitively set up.

In the architecture illustrated by Fig. 3b, the signalling takes place in a corresponding manner except that the ISDN switching centre before the intelligent network switching centre is omitted and the gateway talks directly to the intelligent network switching centre using the TUP/ISUP protocol acknowledged by the intelligent network switching centre.

EXAMPLE 3

When a call is to be made from an ATM telephone to another ATM telephone, the operation is a combination corresponding to the two preceding examples. If the call is set up via the same gateway 3 back to the same ATM network, then it is possible to save on network resources because for this call type there is a special signalling which can be selected according to customer needs.

The call is started by dialling via the calling ATM telephone the listed number corresponding to the target ATM telephone. The call is routed and set up as follows. The ATM telephone starts the call setup by sending a call setup request (SETUP) to the gateway, which carries out the setup of the call to the telephone network by using either DSS#1 signalling or TUP/ISUP signalling, depending on whether the gateway is connected to an ISDN network or to an intelligent network. Depending on the architecture, the call is directed either directly or via the ISDN switching centre to the intelligent network, which identifies the calling ATM telephone on the basis of the data network address, creates an invoicing record and replaces the data network address of the call to be routed with the listed number obtained from the database. Furthermore, the intelligent network analyses the dialled number and recognizes the number as an ATM te-

lephone number, finds in the database the data network address corresponding to the number and the address of the gateway serving the ATM telephone in question. At the same time, the intelligent network recognizes that the call goes to the same gateway, so it closes the invoicing record and marks it as a "number inquiry", which means special call pricing. The intelligent network replaces the original dialled telephone number with the number and data network address of the gateway in a manner to be described later on. On the basis of the number of the gateway 3, the call is routed to the data network. The gateway recognizes by the Forward Call Indicator and the Original Called Party fields of the call that the call has originated from the same gateway, so it receives the data network address and breaks the connection to the intelligent network. The gateway informs the ATM telephone about the new number, which contacts the target directly using the IP address.

When TCP/IP addresses are used and the architectural alternative illustrated by Fig. 3b and TUP signalling are applied, the data network address can be adapted to the data elements applied in the telephone network protocols as follows. For routing, the telephone number and TCP/IP address of the gateway are placed in the number field to be used, as follows. The gateway address, whose allowed length = maximum length - 8 + TCP/IP address encoded into eight four-bit fields, which are BCD coded (*BCD, Binary Coded Digital*) numbers in which it is also possible to make use of over-decadal characters. The maximum length within the network is typically 12 - 16 digits, so it is possible to use 4-8 digits for the routing of the gateway. It should be noted that the "+" sign in this context means that two digit strings are joined together one after the other.

In other cases, architectural alternative of

Fig. 3a and architectural alternative of Fig. 3b together with ISUP signalling, the address, either TCP/IP or NSAP, is coded numerically into the subaddress field of the ISDN subscriber number, normally as a decimal number. In conjunction with the TCP/IP, it is possible to use either a direct decimal number or a coded number in four fields as follows: X1X2X3X4, where each one of the fields X1 - X4 may have a value between 000-255.

Fig. 5 presents a preferred user interface used in a terminal 2b connected to a data network 1a. In practice, the user interface corresponds to the keypad of a normal telephone, and the user interface can be used to control the terminal 2b.

The gateway 3 presented in Fig. 6 comprises a first buffer element 4 for interface 5, from which a connection is provided to a circuit switching telephone network, preferably an ISDN network, using DSS#1 signalling. Furthermore, the gateway 3 comprises a second buffer element 6 for interface 7, from which a connection is provided to a packet switching data network, preferably an ATM network. In addition, the gateway comprises a numeric database 9, in which the terminal identification number range and the corresponding telephone number range are stored. Further, the figure presents a block diagram representing the functions of the gateway, comprising call setdown and error handling, data and voice transfer, number conversions e.g. from an IP address into a telephone number or vice versa, and signalling and call setup between networks.

The invention is not limited to the examples of its embodiments presented above, but many variations are possible within the framework of the inventive idea defined by the claims.

CLAIMS

1. Telecommunication system comprising two telecommunications networks (1a, 1b), such as ATM networks, intelligent networks, ISDN networks or the like, for telephone, data and/or radio communication, and two terminal devices (2a, 2b), such as telephones, computers or the like, which are connected to a telecommunications network for the transmission of telecommunication signals carrying information, characterized in that the telecommunication system comprises a gateway connected to a telecommunications network to transmit telecommunication signals between two telecommunications networks each using a different telecommunication protocol, of which the first telecommunications network is a packet switching network and the second telecommunications network is a telephone network.

2. Telecommunication system as defined in claim 1, characterized in that the gateway (3) comprises a first buffer element (4) designed to adapt a first signalling interface (5) between the packet switching telecommunications network and the gateway, a second buffer element (6) designed to adapt a second signalling interface (7) between the telephone network, preferably a circuit switching telecommunications network, and the gateway, and an adapter (8) electrically connected to the first and second buffer elements to interconnect the first and second signalling interfaces (5, 7).

3. Telecommunication system as defined in claim 1 or 2, characterized in that the first signalling interface is a signalling interface between a packet switching computer network, such as an ATM network, and the gateway.

4. Telecommunication system as defined in any one of claims 1 - 3, characterized in that the second signalling interface is a signalling inter-

face between a telephone network, such as an ISDN network, intelligent network or the like, and the gateway.

5. Telecommunication system as defined in any one of claims 1 - 4, characterized in that a permanent circuit is provided between the terminal (2a, 2b) and the first buffer element (4) to allow the setup of calls implemented using the TCP/IP protocol.

6. Telecommunication system as defined in any one of claims 1 - 4, characterized in that a switched virtual circuit is provided between the terminal (2a, 2b) and the first buffer element (4) to allow the setup of calls implemented using DSS#2 signalling.

7. Telecommunication system as defined in any one of claims 1 - 6, characterized in that the connection for communication between two terminals (2a, 2b) is set up between a packet switching computer network and a circuit switching telephone network.

8. Telecommunication system as defined in any one of claims 1 - 7, characterized in that the telecommunication system comprises a database (9) used to store information identifying the terminal (2a, 2b).

9. Procedure for the control of a telecommunication system, said telecommunication system comprising two telecommunications networks (1), such as ATM networks, intelligent networks, ISDN networks or the like, and two terminal devices (2a, 2b), such as telephones, computers or the like, connected to a telecommunications network for the transmission of telecommunication signals carrying information, characterized in that a gateway (3) is provided in the telecommunication system to transmit telecommunication signals between two telecommunications networks which use different telecommunication protocols, and a connection between the two terminals is set up via the

gateway, the first one of said telecommunications networks being a packet switching network and the other one a telephone network.

10. Procedure as defined in claim 9, characterized in that a first connection is set up between a terminal (2a) and the gateway (3) via a first buffer element (4), a second connection is set up between a terminal (2b) and the gateway (3) via a second buffer element (6) and the first and second connections are interconnected via an adapter (8).

11. Procedure as defined in claim 9 - 10, characterized in that the first connection is set up in a permanent virtual circuit using the TCP/IP protocol.

12. Procedure as defined in claim 9 - 10, characterized in that the first connection is set up in a switched virtual circuit using DSS#2 signalling.

13. Procedure as defined in any one of the preceding claims 9 - 12, characterized in that a first terminal (2a) is connected to a telephone network and a second terminal (2b) is connected to a data network, and that a connection from the first terminal to the second terminal is set up as follows:

data identifying the second terminal is added to a telecommunication signal via the first terminal;

the telecommunication signal is sent into the telephone network via the first terminal;

the data identifying the second terminal is compared in the telephone network to determine the data network address of the second terminal and the address of the gateway (3) connected to the data network;

the identification data is converted into a data network and gateway address;

based on the identification data, the telecommunication signal is routed to the second terminal connected to the data network via the gateway; and

a telecommunication connection between the first and second terminals is set up by means of the gateway.

14. Procedure as defined in any one of the preceding claims 9 - 12, characterized in that a first terminal (2a) is connected to a data network and a second terminal (2b) is connected to a data network and/or a telephone network, and that a connection from the first terminal to the second terminal is set up as follows:

data identifying the second terminal is added to a telecommunication signal via the first terminal;

the telecommunication signal is sent to the gateway (3);

a connection is set up between the first terminal and the gateway;

a connection is set up between the gateway and a telephone network;

the identification data for the second terminal is compared with a predetermined table to determine the address of the second terminal, whereupon

1) if the address of the second terminal refers to a telephone network, then a connection is set up between the first and second terminals via the gateway;

2) if the address of the second terminal refers to a data network, then the identification data is converted into the address of the second terminal in the data network, the address of the second terminal is indicated to the first terminal and a connection is set up between the first and second terminals via the data network on the basis of a data network call setup protocol known in itself.

15. Procedure as defined in any one of the preceding claims 9 - 14, characterized in that the terminal identification data corresponding to the data network address of the terminal (2a, 2b) con-

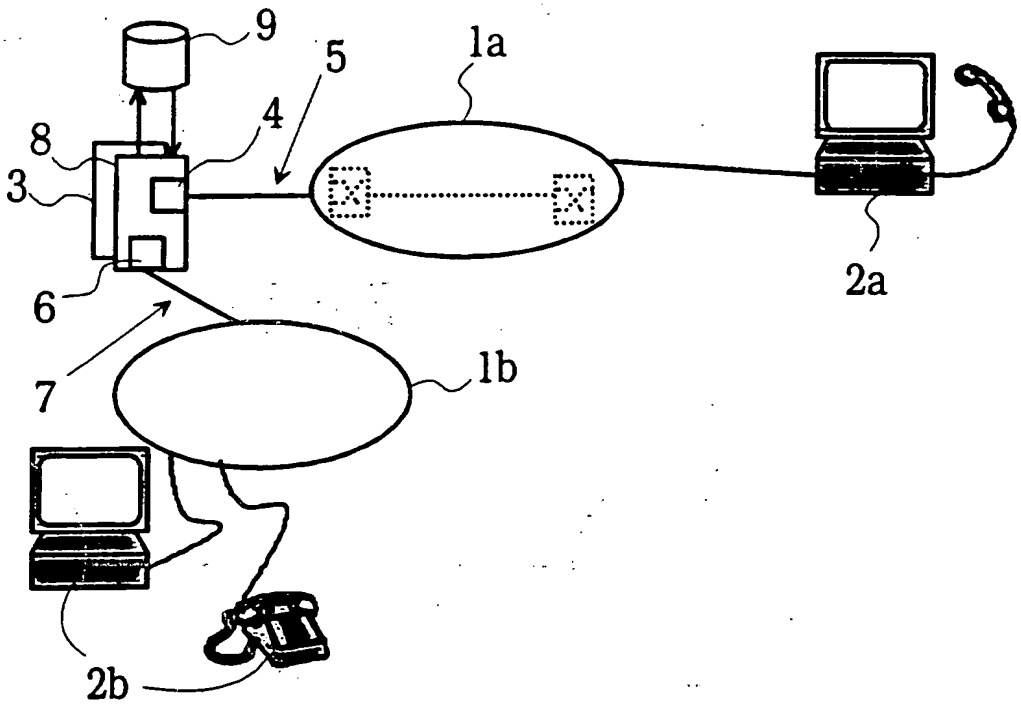

Fig 1

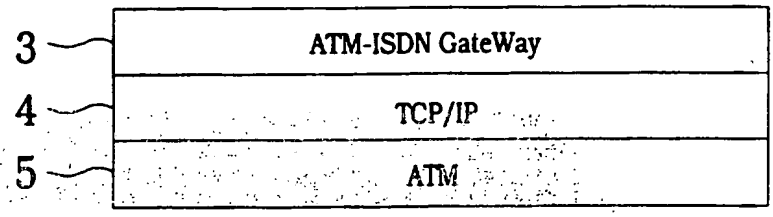

Fig 2a

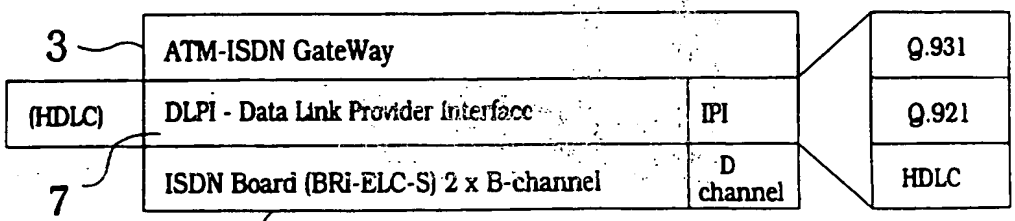

Fig 2b

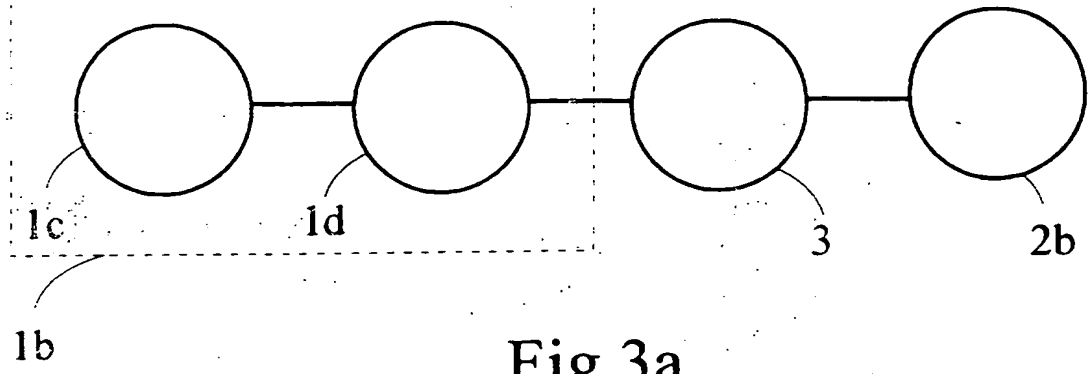

Fig 3a

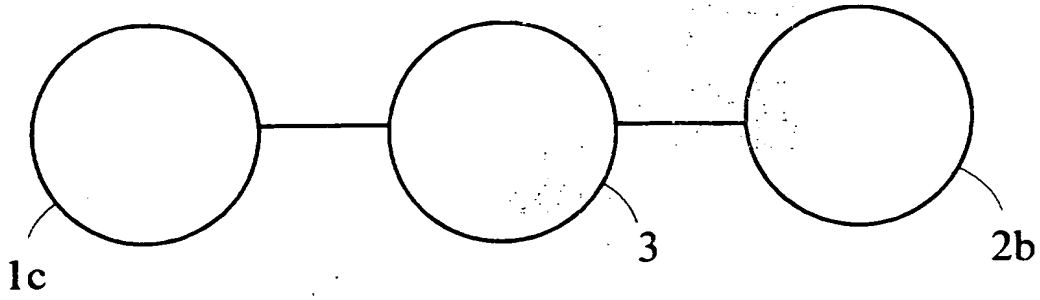

Fig 3b

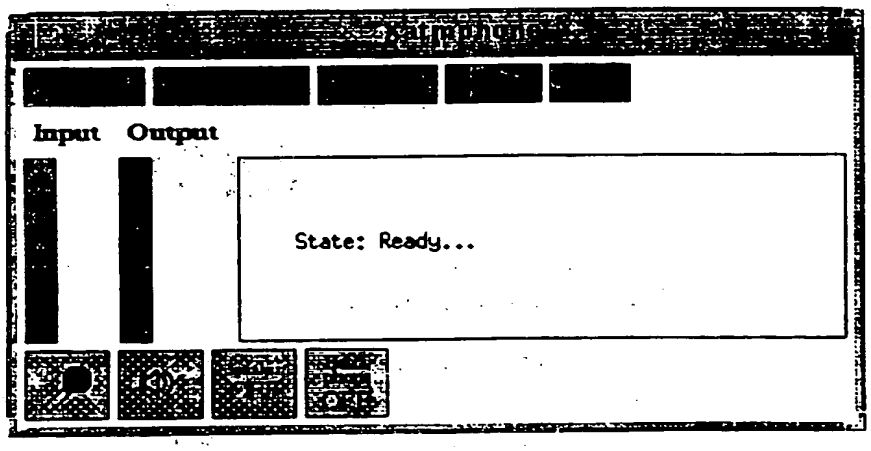

Fig 5

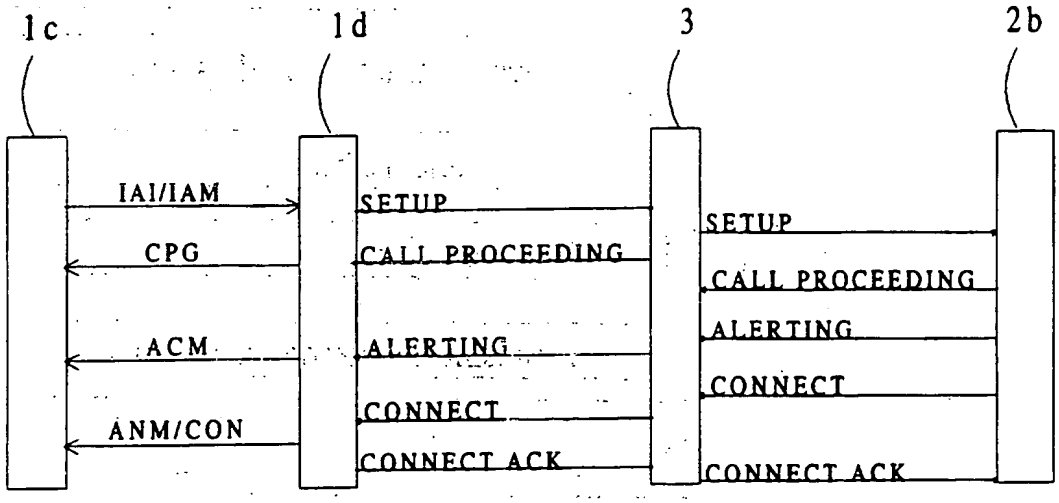

Fig 4a

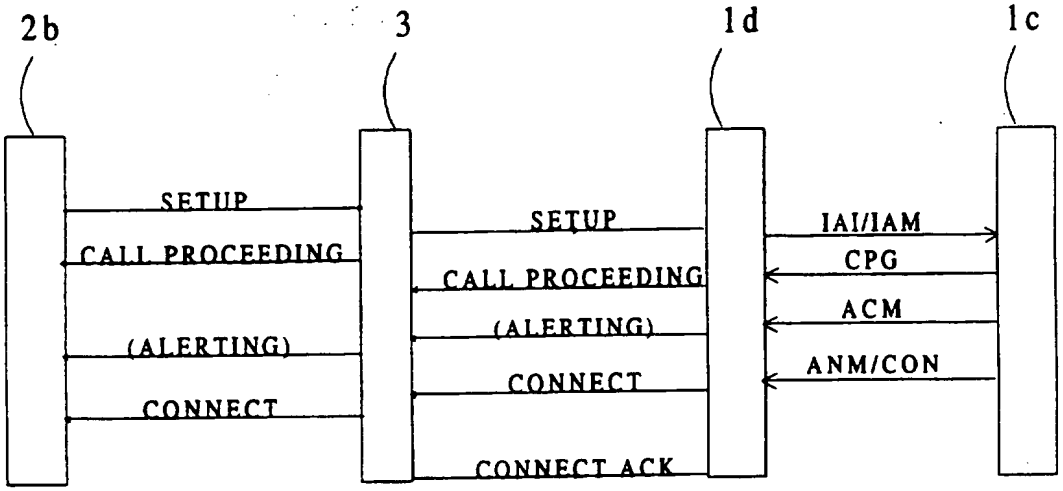

Fig 4b

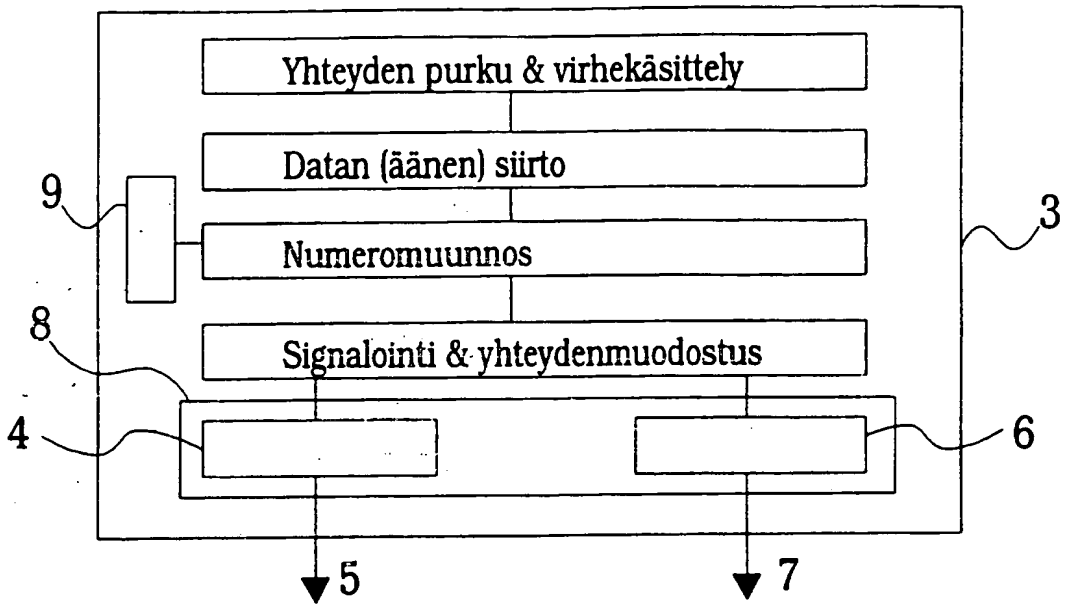
Yhteyden purku & virhekäsittely
Datan (äänen) siirto
Numeromuunnos
Signalointi & yhteydenmuodostus
9
3
8
4
6
5
7

Fig 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 96/00568

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04L 12/66, H04L 12/46
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04L, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IBM Technical Disclosure Bulletin, Vol 35, No 3, August 1992, (Armonk, New York), "Transparent Message Routing Between an SS#7 Network and X.25 Network", p 434-436	1,3,4, 7-9 13,14
A	--	2,5,6,10-12
X	EP 0450819 A2 (AMERICAN TELEPHONE AND TELEGRAPH COMPANY), 9 October 1991 (09.10.91), column 5, line 22 - column 6, line 22; column 8, line 55 - column 9, line 41; column 11, line 38 - column 13, line 8, figures 1,2	1-12
A	--	13,14

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 January 1997	03 -02- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Anders Ströbeck Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 96/00568

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5375118 A (RAO ET AL), 20 December 1994 (20.12.94), column 1, line 9 - line 14; column 3, line 1 - line 39; column 3, line 49 - column 4, line 29, figures 1,2	1-12
A		13,14
	--	
X	WO 9403004 A1 (ITALTEL SOCIETA ITALIANA TELECOMNICAZIONI S.P.A.), 3 February 1994 (03.02.94), page 7, line 23 - page 8, line 18, figure 2	1,3,4,7,9, 11,12
A		2,5,6,8,10, 13,14
	--	
X	US 5341374 A (LEWEN ET AL), 23 August 1994 (23.08.94), column 5, line 63 - column 6, line 18, figure 1	1,3,4,7,9
A		2,5,6,8, 10-14
	--	
A	EP 0269978 A2 (KABUSHIKI KAISHA TOSHIBA), 8 June 1988 (08.06.88), column 3, line 37 - column 4, line 22; column 6, line 20 - line 53	13,14
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI96/00568

Box I **Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 15
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

A part of claim no. 15 is missing in the application, and the part that is present does not give information to such an extent that a meaningful search can be performed.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II **Observations where unity of invention is lacking (Continuation of item 2 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/10/96

International application No.
PCT/FI 96/00568

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A2- 0450819	09/10/91	SE-T3- 0450819	
		AT-T- 132315	15/01/96
		CA-A,C- 2036744	01/10/91
		DE-D,T- 69115740	15/05/96
		ES-T- 2081431	01/03/96
		JP-A- 4225649	14/08/92
		US-A- 5115427	19/05/92
US-A- 5375118	20/12/94	EP-A- 0584687	02/03/94
WO-A1- 9403004	03/02/94	EP-A- 0653132	17/05/95
		IT-B- 1259036	11/03/96
		IT-D- MI921806	00/00/00
US-A- 5341374	23/08/94	NONE	
EP-A2- 0269978	08/06/88	DE-A- 3785832	17/06/93
		JP-B- 7093634	09/10/95
		JP-A- 63138831	10/06/88
		US-A- 4933937	12/06/90